

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 integra-

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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

of 18- to 34-year olds report that online reviews factor into their dining decisions, as do 47 percent of frequent fullservice customers¹."

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 ight fares and restaurant reviews on Google using consumers from Yahoo! and Bing as controls. In

the literature on consumers' response to online advertising and sponsored search results. In particular, this study is complementary to concurrent work by Edelman

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.

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"

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

<<COMP: Place Figure 2 about here>>

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). 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 keywords⁴.

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 contains websites with total clicks above comScore's minimum reporting standard in all months⁵.

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.

<<COMP: Place Table 2 about here>>

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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<<COMP: Place Table 4 about here>>

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

restaurants.

In markets with multiple platforms, consumers have a choice to single-home and

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.

\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 :

$$\log(\text{clicks}_{i,j,k,t}) = \alpha_0 + \alpha_1 \text{Post}_t + \alpha_2 \text{Google}_j + \alpha_3 i + \alpha_4 j + \alpha_5 k + \alpha_6 t + \epsilon_{i,j,k,t} \quad (1)$$

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 α_2 , α_3 , and α_4 are fixed effects at the levels of the website, search engine, keyword, and month, respectively. 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 α_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 γ_1 as the "ratio-of-ratios" (Mullahy, 1999) due to the semi-log specification and the discrete values of the variable $Cost_{Google}$. I calculate the effect of the integration of a Google product on clicks as:

$$\frac{\frac{E[k_{jt} | G=1; P=1]}{E[k_{jt} | G=1; P=0]}}{\frac{E[k_{jt} | G=0; P=1]}{E[k_{jt} | G=0; P=0]}} = \exp(\gamma_1) \quad (2)$$

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 $\exp(\gamma_1)$. 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

<<COMP: Place Table 5 about here>>

Table 5 reports the results of the regression for Google Flights. Columns (1)-(3) indicate that the main effect *Google Post* is not statistically significant. Columns

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 engines¹³. The increase in total clicks arises primarily from the increase in non-paid clicks¹³. The change in paid clicks is not precisely estimated.

<<COMP: Place Table 6 about here>>

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

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 Go27

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.

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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.

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

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 restaurant 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.

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6.4 Rankings and Non-paid Clicks

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

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

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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

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

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

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Notes

¹"Fullservice" restaurants refer to restaurants with full 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,

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 <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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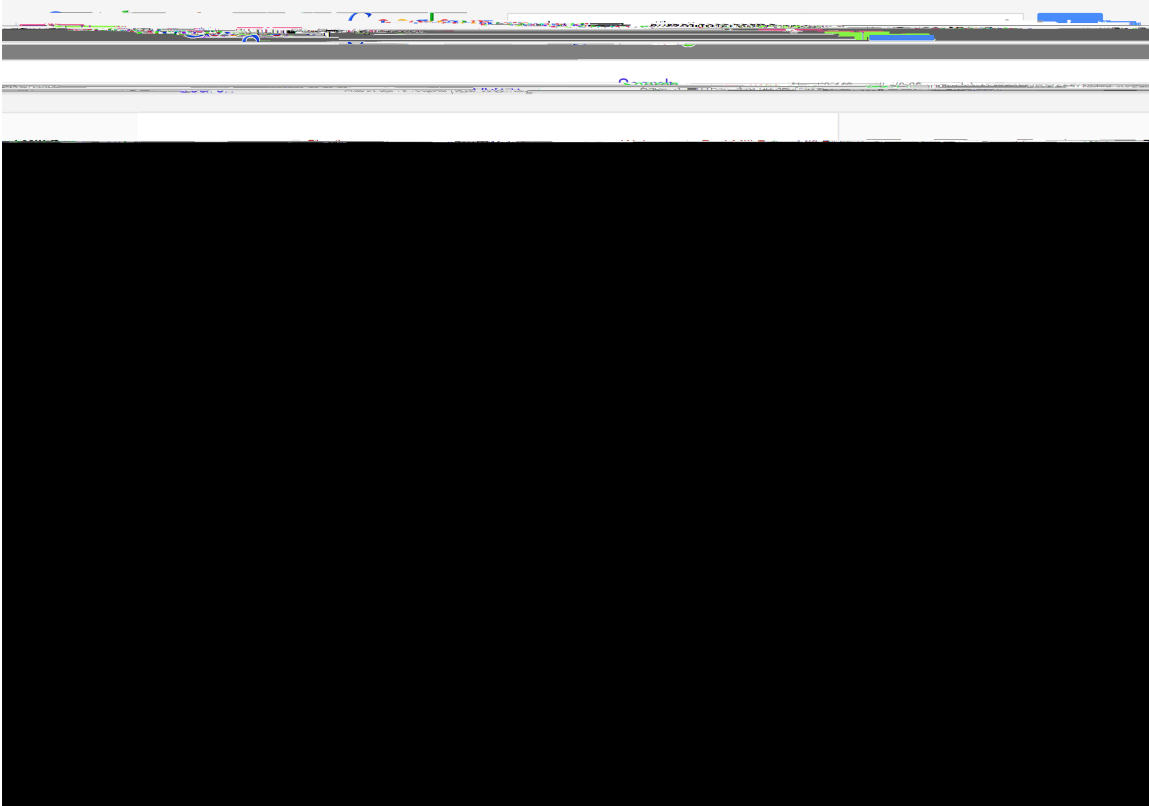
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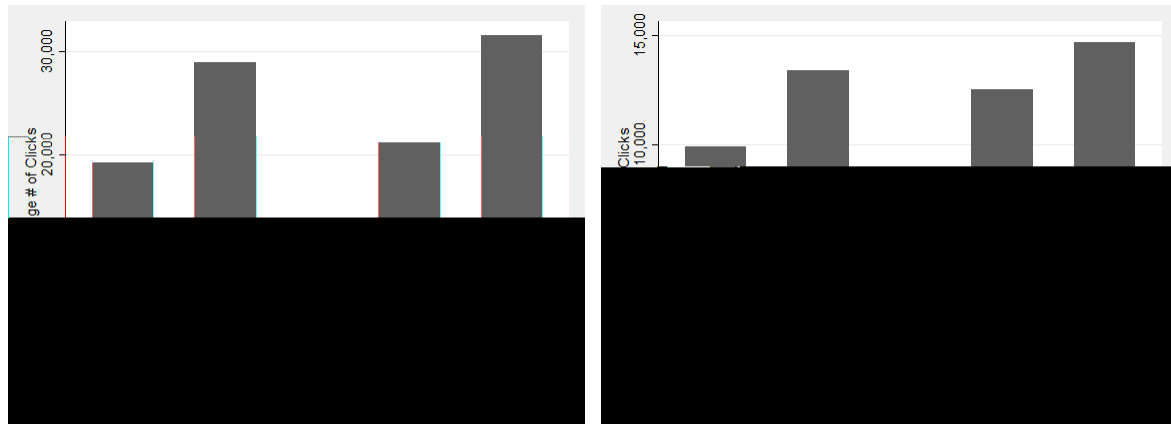
Headline Attention from WSJ." Search Engine Land December 27.

Figure 2: Screen shot of restaurant search on Google



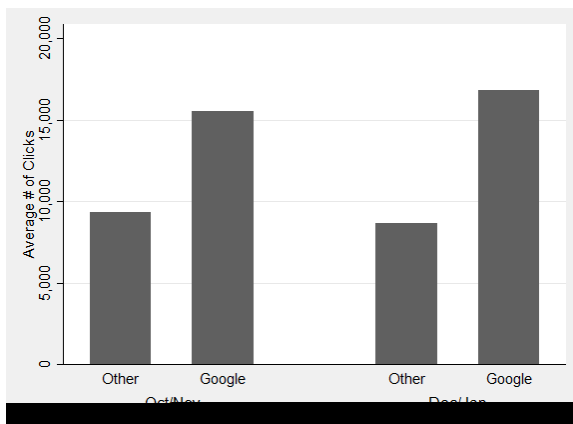
Source: Original figure and arrows from searchengineland.com, "Google Places is Over, Company Makes Google Plus the Center of Gravity for Local Search," May 30, 2012

Figure 3: Seasonal changes in clicks for Google and other search engines for searches on ight fare that do not contain the keyword \cheap"



(a) # Total clicks

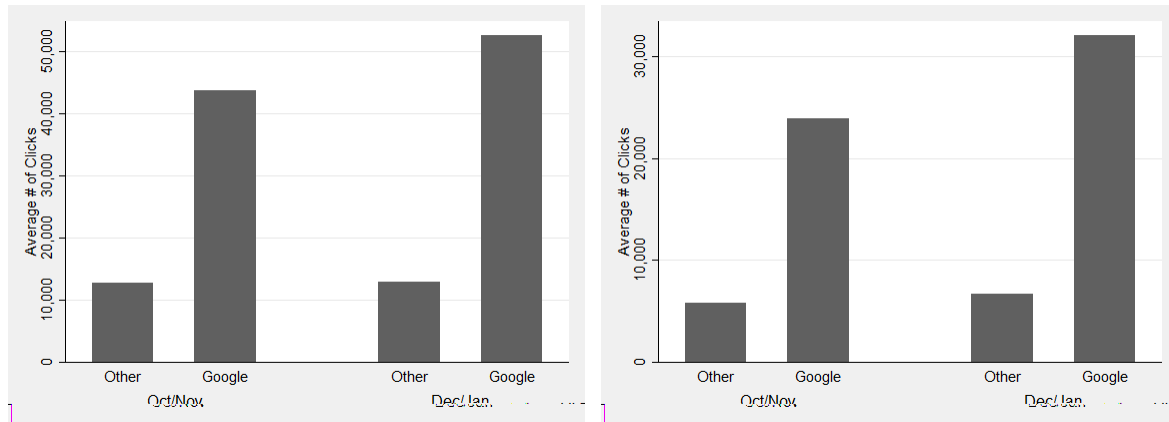
(b) # Paid clicks



(c) # Non-paid clicks

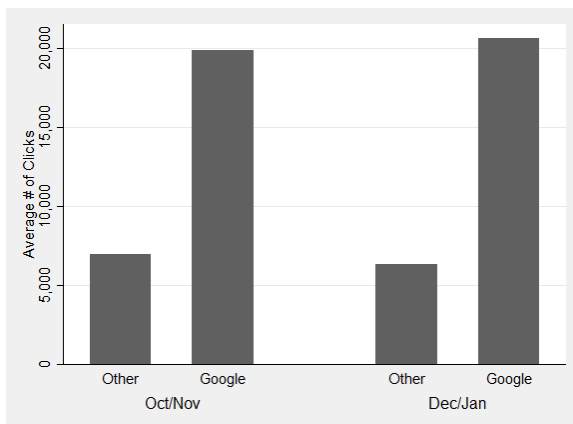
Note: The label \Google" refers to Google, and the label \Other" refers to the other search engines, Yahoo! and Bing. The time period covers October 2011 to January 2012|the two months before and after the integration of Google Flights into Google's search results.

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

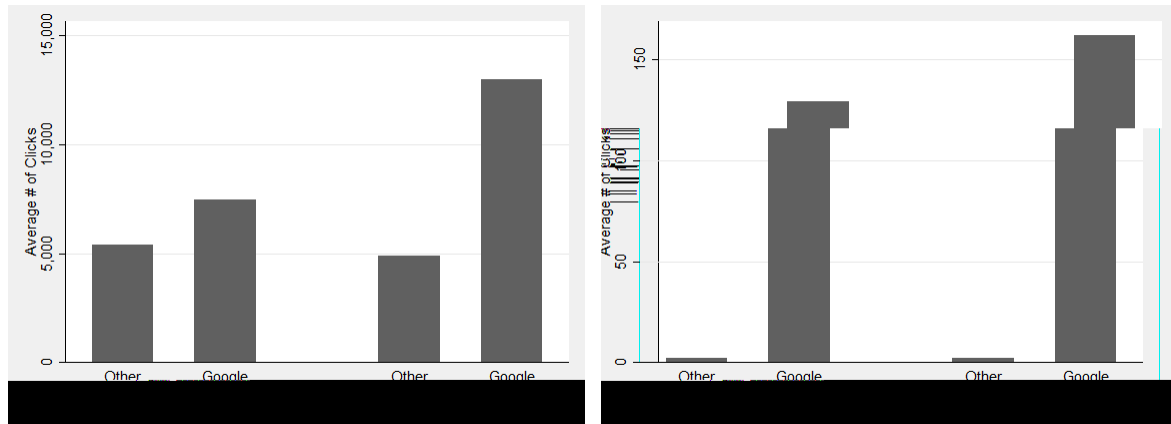
(b) # Paid clicks



(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

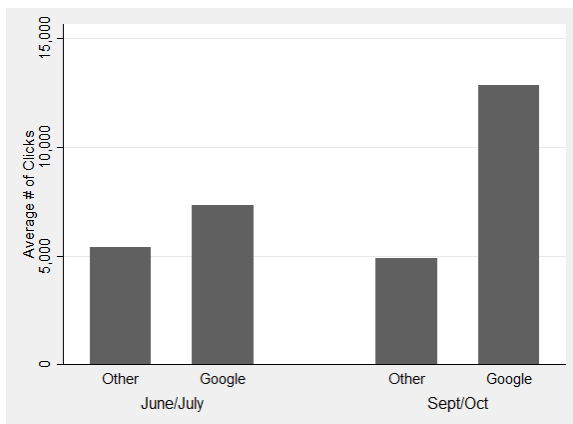
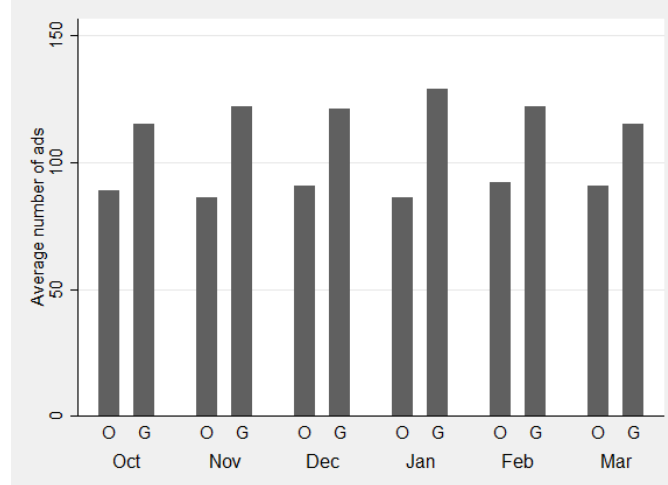
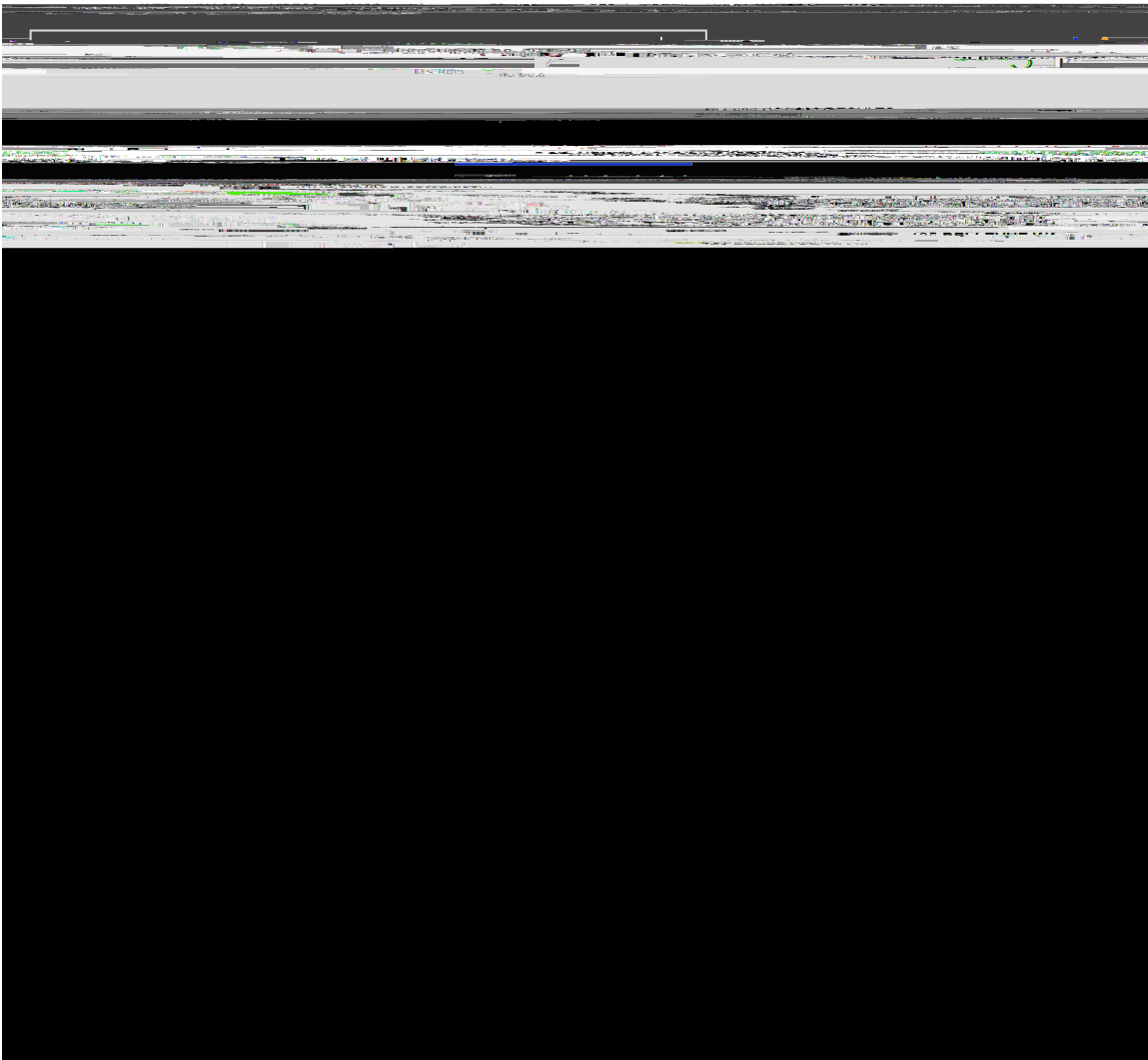


Figure 6: The number of ads on Google and other search engines



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



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 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

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	Google	0.651 (0.239)	0.0427 (0.241)	0.717 (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. \dagger $p < 0.1$, $** p < 0.05$, $*** p < 0.01$. 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 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 Google 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 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 Cheap	0.529	-0.203	-0.272	1.251		

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

(1) (2) (3)

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

Flights

				(1)
Post	Google			-1.963 (0.854)
Post	Google	Number of ads		0.0972 (0.0417)
Post	Google	Cheap		4.624 (1.309)
Post	Google	Cheap	Number of ads	-0.209 (0.0807)
Post		Number of ads		-0.0591 (0.0356)
Post		Number of ads		0.0246 (0.0336)
Post		Cheap		-3.397 (1.065)
Google		Cheap		-0.815 (0.880)
Cheap		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	0.492	0.0305	-0.514	-0.108	-0.498
			(0.212)	(0.414)	(0.395)	(0.488)	(0.224)	(0.487)
FakePost	Google	Cheap	-0.256	-0.0495	-0.124			
			(0.266)	(0.559)	(0.522)			
FakePost		Cheap	0.217	0.175	0.416			
			(0.227)	(0.523)	(0.439)			
Google		Cheap	0.391	-0.302	0.301			
			(0.210)	(0.550)	(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

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	-0.293	0.254	0.115	-0.157	0.307
			(0.136)	(0.267)	(0.366)	(0.232)	(0.215)	(0.346)
Post	Google	Cheap	-0.0975	-0.614	2.484			

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	Bing Yahoo!		-0.00626	0.241	0.283	-0.308	0.115	-0.319
			(0.155)	(0.528)	(0.261)	(0.271)	(0.0953)	(0.272)
Post	Bing Yahoo!	Cheap	-0.0293	0.0846	-0.226			
			(0.170)	(0.471)	(0.268)			
Post	Cheap		0.0781	-0.0457	0.162			
			(0.127)	(0.309)	(0.251)			
Bing Yahoo!	Cheap		-0.642	-1.133	-0.488			
			(0.250)	(0.476)	(0.322)			
Month Fixed Effects			Yes	Yes	Yes			