Google attention and target price run ups

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Acknowledgement
I am grateful to Gillian MacIver for her support with data collection, to FSA staff for an insightful discussion on the topic, and to two anonymous referees for valuable suggestions.

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ABSTRACT

We explore the increase in the share prices of target firms before their merger announcements. We use a novelty Google search volume to proxy the market expectation hypothesis according to which firms with an abnormal upward change in Google searches are identified as firms with potential merger activity. We find that Google indicators can explain a larger percentage of the price increase in target firms before their mergers than the Financial Times. However even the Google proxy of the market expectation hypothesis can only explain at best 36 percent of the target price run ups.

Keywords: Target price run ups, mergers, market anticipation, Google search volume

JEL classification: G14; G34

1. Introduction

A number of academic studies have reported that share prices of target firms do increase significantly prior to their merger announcement and have developed two hypotheses to explain such a pattern. According to the insider trading hypothesis (Keown and Pinkerton, 1981), staff from the target, bidding, or financial institution that organized the transaction trade or even pass such information on to relative members. According to the alternative market expectation hypothesis (Jensen and Ruback, 1983), investors, based on publicly available information, manage to predict target firms prior to their merger announcements.

This paper focuses on the latter hypothesis exploring whether the target price run ups are driven by public information. Prior studies have used media coverage to proxy the market expectation hypothesis, with investors being able to predict target firms as long as such information was documented in the media. Early studies in the field (e.g., Pound and Zeckhauser, 1990; Zivney et al., 1996) have focused on the newspaper coverage of a particular column, such as the columns *Heard on the Street* and/or *Abreast of the Market*, with more recent studies (e.g., King, 2009) incorporating a wider coverage of articles with the assistance of databases such as Factiva. The majority of those studies have concluded that media coverage can only explain part of the increase in target share prices prior to their merger announcements. Within the UK literature, Holland and Hodgkinson (1994) explore 86 target firms from 1988 to 1989 and Siganos and Papa (2012) 1,059 firms between 1998 and 2010. Within Holland and Hodgkinson's limited sample, rumors covered by Financial Times (FT) drive to a large extent the UK target price run ups. Siganos and Papa report that in line with international literature, FT coverage of rumors can only explain a small percentage of

the upwards UK target pattern. However, prior studies have not captured all publicly available information; as an example, none of the prior UK/international studies in the field has incorporated investors' discussions on online sites such as *Hotcopper.com.au*, though Clarkson et al. (2006) and Chou et al. (2010) have found that such merger rumors have a significant impact on firms' share returns. Therefore, prior studies' conclusions may be biased due to the limited news coverage.

Based on the difficulty of capturing all available public information, we explore an alternative approach to proxy the market expectation hypothesis by using the volume of Google searches for target firms. Google is the most widely used web search engine and the only search site that offers historic searching volume data appropriate for academic purposes.[1] If investors encounter a rumor of a potential merger, most investors may use Google to search for further information on the target company before proceeding with a transaction; therefore, firms featured in a rumor are expected to experience an abnormal increase in Google search activity. A few recent studies have reported the significance of Google searches as a measure of investor attention. Da et al. (2011) explore the best proxy of investor attention in US firms and find that Google searches capture investor attention earlier than existing proxies, such as newspaper coverage, and Bank et al. (2011) support the significance of Google search volume as a proxy of investor attention in German stocks. Other recent studies have also shown the significance of Google searches within alternative fields in finance. Da et al. (2012) report that Google searches are value relevant and have the ability to predict firms' revenue surprises, and Drake et al. (2011) report that Google searches are related to firms' price and trading volume levels before and on the earnings announcement day, with firms with high Google activity prior to the announcement experiencing a smaller price and volume response on the announcement day.

[1] For a brief review of Google, study http://en.wikipedia.org/wiki/Google (last accessed September 2012).

We study the Google search volume of target firms within the merger context to explore whether the mergers were expected by investors. We first explore whether Google search volume can predict mergers before such rumors are reported in FT and, second, whether Google attention can explain the target price run ups pattern. As an example, Figure 1 shows daily Google search volume for RHM plc between October and December 2006; Premier Foods plc acquired RHM plc on 4th December 2006. We find an increase in the volume of RHM's Google search activity a few days prior to the merger announcement: Google attention was 0.13 on 29/11/2006, 0.19 on 30/11/2006, 0.39 on 1/12/2006, 0.59 on 2/12/2006, 0.80 on 3/12/2006, and 1 on 4/12/2006, before moving back to normal levels of Google attention.[2] Between October and December 2006, we have only identified two FT articles that document a potential merger deal for RHM, published on 2/12/2006 (Wiggins and Hume, 2/12/2006) and on 3/12/2006 (Wiggins, 3/12/2006). There is, therefore, a sign that investors were searching for information on RHM plc earlier than FT covered potential merger activity.

To test our argument, we manually download daily Google activity for 340 UK target firms between March 2004 and December 2010. We adopt the outlier literature to identify abnormal upward changes in Google searches by using the boxplot method (Tukey, 1977), which makes no distributional assumptions. Following an event study analysis, we estimate excess returns of target firms before their merger announcement date and before the first date that abnormal Google activity was signaled. We find that Google indicators tend to offer a takeover signal a few days earlier than FT, and we therefore find that Google indicators explain a larger percentage of the price increase in target firms than a conventional FT

[2] Notice that Google search data are given at a relative value to the total searches in the sample period requested that ranges between 0 and 1, where 1 indicates the day with the maximum number of searches. Also notice that Google search volumes may slightly change when collected at different points in time, since Google calculates the values from a subset of the full archive to increase the response speed. In line with Da et al. (2011), we download results for a few firms within alternative times and find that the correlation of the data is above 0.95; we therefore conclude that our results are not driven by such approximations.

coverage proxy. Nevertheless, even after estimating excess returns before the Google merger signals, the target price run ups remain economically and statistically significant, showing that Google indicators cannot fully explain the price pattern. We find that Google can explain at best merely 36 percent of the target price run ups.

The remainder of the paper is structured as follows. The next section explains the data and methodology used, section 3 discusses the empirical results and section 4 concludes the study.

2. Data and methodology

2.1 Data collection

We use Thomson OneBanker to have access to all UK target firms with at least a 50 percent level of acquisition between March 2004 and December 2010. To be selected in the sample, a target firm should have an available Datastream code in Thomson OneBanker (to link Thomson OneBanker and Datastream), daily share returns[3] and a ticker symbol in Datastream. In line with other studies that have used Google data (e.g., Da et al., 2011), we use the ticker, rather than the name of the firm, to collect data from Google, since tickers are prominently used by investors rather than by consumers interested in a firm's product. The final sample consists of 430 target firms. In unreported results, we find that the increase in the share prices of those target firms commences 30 days prior to their merger announcement, which sets the sample period of the study and is well in line with the time frame used in the majority of studies in the field (e.g., Holland and Hodgkinson, 1994).

[3] We use the RI data type that incorporates dividend payments in the estimation of share returns.

Two main data sources are used to explain the target price run ups. First, we download FT coverage for target firms from NewsBank.[4] In line with Dyck et al. (2008) and Ferguson et al. (2011), we focus on FT coverage since FT is the most influential newspaper with the most credibility among investors and is also the most comprehensive for firms' financial news. Siganos and Papa (2012) and Holland and Hodgkinson (1994) are also the only other UK studies in the target price run ups literature, and both studies have used FT coverage to proxy news; we therefore focus on FT for comparison purposes.

Second, we manually download daily Google activity for each target firm by using the Google insight website.[5] Notice that Google offers historic volume data since January 2004, which determines the sample period of the study. Out of 430 target firms, 95 firms do not have available daily Google data, since Google reports research volume data only if a search is above a minimum threshold. We retain all 430 firms in our analysis, since limited Google searches for a target firm indicate that investors did not manage to predict the merger. The Google search data are also given as a relative value to the total searches in the sample period requested, which ranges between 0 and 1, with 1 indicating the day with the maximum number of searches. We use the worldwide selection to identify firms' research volume over time to incorporate the activity of international investors and, since we require daily frequency, we also set a three-month period before each firm's merger, which covers the period that the target price run ups pattern is present.[6]

2.2 Determining abnormal upward change in Google activity

We estimate abnormal Google volume using two measures for robustness purposes:

[4] Notice that the FT data used in this study have also been used by Siganos and Papa's (2012) study exploring the target price run ups in the UK between 1998 and 2010. The current study instead focuses on whether Google indicators can explain the target price run ups pattern and whether Google can explain a larger percentage of returns than FT. For a more detailed description on FT data, please study the above mentioned paper.
[5] http://www.google.com/insights/search/ (last accessed September 2012).
[6] If the length of the search is longer than three months, data are only available in a weekly frequency.

$$AGoogle1_i = \ln(1 + Google_{it}) - \ln(1 + Google_{it-1}) \quad (1)$$

$$AGoogle2_i = \ln(1 + Google_{it}) - \ln[Median(1 + Google_{it-41}),...,(1 + Google_{it-50})] \quad (2)$$

where $Google_{it}$ is the Google activity of firm i on day t that we adjust to a range between 1 and 2 for estimation purposes. $AGoogle1_i$ and $AGoogle2_i$ are estimated daily from -40 days to the day of the merger announcement to capture the target price run ups. $AGoogle1_i$ shows the daily change in Google search volume and $AGoogle2_i$ shows the abnormal daily change above the normal Google activity for each target firm, as estimated by the median number of searches about the firm between -41 and -50 days before the merger. Figure 2 shows the cumulative abnormal Google searches for both measures from -30 days until the day the merger was announced. The figure shows that both $AGoogle1_i$ and $AGoogle2_i$ tend to show an increase in Google activity closer to the merger announcement day, with such upward pattern being stronger for $AGoogle2_i$. The average daily growth of the Google search volume over the last five days prior to the merger announcement for $AGoogle1_i / AGoogle2_i$ is 0.29/0.40 percent, and the corresponding growth on the day of the merger announcement is 0.37 and 1.19 percent, respectively.

To identify the first day that investors are aware of a potential merger, we first use FT coverage and select the first rumor article available for each target firm. Since $AGoogle1_i$ and $AGoogle2_i$ are continuous variables, we follow the outlier literature to determine abnormal upward changes. To determine the most appropriate statistic to explore outliers, Table 1 explores the distribution of both measures. We find that $AGoogle1_i$ and $AGoogle2_i$ are positively skewed (0.11 and 0.25, respectively), with acute peaks (11.13 and 9.41, respectively), and Kolmogorov Smirnov statistics show that $AGoogle1_i$ and $AGoogle2_i$ do

not follow normal distribution at the 1 percent level. We therefore use the boxplot method (Tukey, 1977) to identify outliers, which makes no distributional assumptions and is applicable to data that is not heavily skewed. We identify outliers as follows:

$$Outlier_{it} > Q3_i + 1.5 * (Q3_i - Q1_i) \quad (3)$$

where $Q3_i$ and $Q1_i$ are, respectively, upper and lower quartiles for firm i over the period between -40 days and the day of the merger announcement. The first abnormal upward change in Google activity for each firm is the first signal of a potential takeover activity.

Table 2 explores the relationship between Google and target share returns. Panel A of Table 2 explores whether Google's abnormal upward changes in $AGoogle1_i$ and $AGoogle2_i$ have an impact on share returns on the day that those signals were identified as well as over the following days. Notice that excess returns at day t indicate a simple arithmetic average across all target firms for that day and for robustness reasons, we estimate alternative risk-adjusted excess returns: the market excess returns (ER_{iM})[7], the CAPM market-adjusted returns (ER_{iCAPM})[8], and the three-factor model adjusted returns (ER_{iFF3})[9]. We find that the daily market-adjusted returns (ER_{iM}) for $AGoogle2_i$ are 1.74, 1.57, 0.81, and 0.25 percent on day t, $t+1$, $t+2$, and $t+3$ after the takeover signal, with returns being statistically significant at least at the 10 percent level until two days after the signal. These results show that there is a link between abnormally high Google searches and corresponding share

[7] $ER_{iM} = R_{it} - R_{Mt}$, where R_{it} is the return of firm *i* in day *t*, and R_{Mt} is the market return (FTSE All Share) in day *t*.

[8] $ER_{iCAPM} = R_{it} - (\hat{a}_i + \hat{b}_{iM} R_{Mt})$, where $\hat{a}_i, \hat{b}_{iM}$ coefficients are estimated over the interval from -41 to -120 days before the merger announcement (day 0).

[9] $ER_{iFF3} = R_{it} - (\hat{a}_i + \hat{b}_{iM} R_{Mt} + \hat{b}_{iSMB} SMB_t + \hat{b}_{iHML} HML_t)$, where SMB_t and HML_t reflect the size and book/market risk proxies, respectively. The factors are estimated in line with Fama and French (1993). $\hat{a}_i, \hat{b}_{iM}, \hat{b}_{iSMB}, \hat{b}_{iHML}$ coefficients are estimated over the interval from -41 to -120 days before the merger announcement (day 0).

returns; therefore, when we estimate at a later stage returns before such merger signals, excess returns are expected to decrease.

Panel B of Table 2 further explores the robustness of prior result by testing whether there is in general a positive relationship between share returns and Google activity. We estimate the following OLS regression:

$$ER_{it} = a_0 + a_1 AGoogle_{it} + a_2 AGoogle_{it-1} + a_3 AGoogle_{it-2} + a_4 AGoogle_{it-3} + u_{it} \quad (4)$$

where all three measures are used to estimate excess returns ER_{it} (ER_{iM}, ER_{iCAPM} and ER_{iFF3}) and both Google's volume are employed ($AGoogle1_i$ and $AGoogle2_i$). We estimate the above regression within firms with data available between their initial takeover signal and their merger announcement day. Notice that all days/data per firm between the merger announcement and the first merger signal are incorporated into the regression. In unreported results, we also estimate the Variance Inflation Factors (VIFs), to test for potential multicollinearity amongst the explanatory variables, and find that most VIFs are slightly over 1 and the maximum VIF is equal to 2.15. These results show that there is no evidence of multicollinearity.

Empirical results to some extent support findings reported at Panel A of Table 2, since we find that there is a positive relationship between contemporaneous/lagged Google activity and target share returns when up to two lags are employed. In unreported results, we further re-estimate above regression per day before the merger announcement day and find that the findings of the relationship between Google activity and share returns tend to remain similar across the days between the merger announcement and the initial merger signal. Overall, in line with existing literature (e.g., Da et al., 2011), these results support the positive relationship between Google volume and share returns within the UK merger context.

3. Empirical results

3.1 Initial findings

Before we estimate excess returns in relation to takeover signals, we offer a description of our abnormal Google variables in relation to FT coverage. Panel A of Table 3 shows the number of firms with potential takeover activity that was found. Following the boxplot method, we find that 150 ($AGoogle1_i$) and 116 firms ($AGoogle2_i$) out of the total of 430 firms were found to be signaled as potential target firms. Stated differently, the boxplot method offers outliers only in firms that experience significant abnormal upward changes in Google volume. FT offers rumor articles for 127 firms. Interestingly, we find that the first signal of potential merger activity is on average -20 days prior to the merger for both Google variables and -16 days for FT, showing that Google search volume of firms on average increased significantly before rumor articles were published on FT.

Panel B of Table 3 also explores whether Google indicators and FT identify the same firms as potential target firms. For example, $AGoogle1_i$ and FT similarly identify that 249 firms are or are not to become targets, while such indicators show a different outcome in the remaining 181 firms (a total of 430 firms). Both measures therefore indicate the same signal in merely 58 percent of the firms. We therefore conclude that there is a variation of firms that Google variables and FT identify as potential targets, with signals being relatively close between $AGoogle1_i$ and $AGoogle2_i$ from construction, showing that Google abnormal upward changes do not simply reflect FT's coverage of rumors.

Panel C of Table 3 also explores firms for which both Google indicators and FT signal potential merger activity, and shows which of the signals appears first. In line with the above results, we find that Google indicators seem to precede those of FT; as an example, out of 48

firms with $AGoogle1_i$ and FT signals, $AGoogle1_i$ shows a takeover signal first in 34 of those firms. Results are even stronger in favor of $AGoogle2_i$ in relation to FT (22 out of 28 firms).

Overall, to some extent in line with Da et al. (2011) and Bank et al. (2011), these results show that Google indicators seem to capture investor attention earlier than media coverage.

3.2 Estimation of excess returns

We then follow an event study analysis to explore the abnormal returns prior to the merger announcement and prior to the abnormal upward change in Google activity. Table 4 shows the daily returns until five days before the merger announcement (day 0) and the cumulative abnormal returns (CAR) every ten days over the thirty days prior to the merger. Excess returns at day t indicate a simple arithmetic average across all target firms for that day and CAR(j,k) indicates the sum of those daily excess returns between day j and k. Panel A of Table 4 shows the excess returns in relation to the merger announcement and indicates that in line with the literature (e.g., Gupta and Misra, 1989; Mathur and Waheed, 1995; King, 2009), share prices of target firms increase significantly before their merger announcement, where the rate of increase is higher closer to the merger announcement. For example, cumulative market excess returns (ER_{iM}) are 5.09, 2.69, and 1.53 in the intervals (-1,-10), (-11,-20), and (-21,-30), respectively. CAR (-1,-30), which are to be explained by Google indicators, are 9.30 (ER_{iM}), 10.82 (ER_{iCAPM}), and 10.04 (ER_{iFF3}) percent, with returns being statistically significant at the 1 percent level.

We then explore whether $AGoogle1_i$ (Panel B of Table 4) and $AGoogle2_i$ (Panel C of Table 4) can explain such profitability of target firms by estimating excess returns before the first $AGoogle1_i / AGoogle2_i$ signal (when there is one available) or otherwise before the merger announcement day. Stated differently, day 0 reflects the day with the first merger

signal, otherwise the merger announcement day. For brevity reasons we only discuss the market excess returns (ER_{iM}), since conclusions are identical for alternative excess estimations (ER_{iCAPM}, ER_{iFF3}). CAR (-1,-30) are 5.91 prior to $AGoogle1_i$ and 7.13 prior to $AGoogle2_i$ (versus 9.30 percent before the merger announcement), with all returns remaining economically and statistically significant at the 1 percent level. Our results therefore show that Google indicators used in the study fail to fully explain the target price run ups pattern, showing that the increase of target share prices could not be predicted by market participants. We find that Google indicators can explain at best only 36 percent of the target price run ups at the time interval between -1 and -30 ($AGoogle1_i$ / ER_{iM} scenario).

We then explore whether Google can explain a larger percentage of excess profitability than conventional FT coverage, and we therefore compare excess returns between FT coverage and $AGoogle1_i$ (Panel D of Table 4), and FT coverage and $AGoogle2_i$ (Panel E of Table 4). Results show that Google indicators show a signal a few days earlier than FT, and the difference in excess profitability between FT and $AGoogle1_i / AGoogle2_i$ is economically and statistically significant at the 1 percent level when estimating CAR (-1,-10). CAR (-1,-30) also show that excess returns are always lower for Google indicators in relation to those found for FT. Such differences may be economically significant, with returns varying from -0.77 to -2.34 depending on the excess return measure followed, but they are statistically insignificant at the 10 percent level.[10]

Overall, we find that Google indicators explain a larger percentage of targets' excess returns before their merger than FT. Nevertheless, Google indicators can only capture a relatively small part of the target price pattern.

[10] For example, the excess return of -2.34 percent shown in Panel D of Table 4 has a p-value equal to 0.13.

3.3 Robustness tests

We undertake a number of tests to explore the robustness of our key results. We find that 6.28 percent of the tickers are noisy, such as 'ice', 'boy', and 'fee', and, in line with Da et al. (2011), we exclude them from the sample and re-estimate prior analyses. Panel A of Table 5 shows the results. Notice that due to space considerations, we only show excess returns for CAR (-1,-10) and CAR (-1,-30) prior to $AGoogle1_i$, $AGoogle2_i$, and the difference in corresponding returns between Google indicators and FT. We find that after controlling for noisy tickers, results are similar with those reported in Table 4. Google indicators may fail to explain in full the target price run ups, but Google indicators explain a larger percentage of such profitability than FT. Cumulative abnormal returns in the interval between -1 and -10 are always economically and statistically lower for $AGoogle1_i$ and $AGoogle2_i$ than corresponding excess returns for FT.

In addition, we re-estimate prior tests based only on 345 firms with 100 percent merger activity. This test explores whether prior results were driven by the sample selection of target firms with over 50 percent merger activity. Panel B of Table 5 shows that prior results hold within such subsample.

We further conduct tests of the stability of our results during the sample period since the sample includes the financial crisis. Figure 3 explores the annual cumulative excess returns in the interval between (-1,-10) and (-1,-30) for FT coverage, $AGoogle1_i$, and $AGoogle2_i$. We find that results are strong regarding CAR (-1,-10), with excess profitability being lower for Google indicators than FT in all seven years. Regarding CAR (-1,-30), results are weaker in favor of $AGoogle1_i$ and $AGoogle2_i$, since Google indicators display respectively lower excess returns in five and four (out of seven) years than those reported in FT. We further explore the impact of financials on prior results. Financials may have received increased

Google search volumes during the financial crisis and therefore, an increase in Google activity in a financial firm may be driven due to the crisis rather than to a takeover rumor. We exclude from the sample 47 financials and re-estimate excess returns. Panel C of Table 5 shows that results remain similar within the non-financial subsample and we therefore conclude that the financial crisis does not drive the results of the study.

We further explore whether our results are driven by firms that reported financial year end results close to the merger announcement, since such firms may face increased Google search activity due to such information rather than to a takeover signal. We exclude 64 firms with financial results reported up to 60 days prior to their merger announcement and re-estimate excess returns. Panel D of Table 5 shows the results. We find that excess returns are reduced slightly across portfolios, showing that Google search activity is related with firms' financial year end results, however prior determined price patterns hold strong within the sub-sample.

Overall, our robustness tests support our prior conclusions on the significance of Google indicators capturing target firms earlier than FT, but without managing to explain the target price run ups pattern.

4. Conclusion

A number of studies (e.g., King, 2009) have found that the share price of target firms increases before their merger announcements. Studies that have explored whether investors could have predicted the target firms have used media coverage as a proxy, with investors managing to predict a merger as long as a rumor was reported before the announcement. Based on the difficulty of capturing all information available to investors, especially in recent years, when internet resources and chat discussions are heavily used, we followed an

alternative approach. If investors encounter a rumor of a potential merger, most investors may use Google to search for further information on the target company before proceeding with a transaction; therefore, firms that feature in a rumor are expected to experience an abnormal increase in Google search activity.

We used the outlier literature, and more specifically the boxplot method (Tukey, 1977), to identify the days that target firms experience an abnormal upward change in Google use of targets' tickers, signaling potential merger activity. We then followed an event study analysis to estimate excess returns before the merger announcement and before the Google takeover signals. We found that Google indicators tend to signal target firms earlier than FT; therefore, the excess returns prior to Google indicators are lower than those reported prior to FT. Nevertheless, we found that Google indicators cannot explain the target price run ups and can capture at best merely 36 percent of the increase in the target price pattern. Although we did not explore insiders' transactions, part of the remaining upwards price pattern could be attributed to private information.

The findings of the study are of interest to regulators. The Takeover Panel has been responsible for the takeover rules in the UK since 1968. As an example, on 19th September 2011 the Panel implemented amendments on the existing takeover code to minimize the target price run ups and amongst others, target firms were given the responsibility to make publically available any bid approach.[11] Future research can explore whether such changes to the regulations may increase the significance of public information on explaining the UK target price run ups.

[11] http://www.thetakeoverpanel.org.uk/wp-content/uploads/2008/11/transitionalarrangements.pdf (last accessed September 2012).

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Table 1
Descriptive statistics of Google indicators

	$AGoogle1_i$	$AGoogle2_i$
Average	0.03%	0.05%
Median	0.00%	0.00%
Min	-69.31%	-57.66%
Max	69.31%	69.31%
Standard deviation	8.40%	10.53%
Skewness	0.11	0.25
Kurtosis	11.13	9.41
Kolmogorov Smirnov	0.09***	0.11***

Notes: This table offers the descriptive statistics of indicators generated by Google Data. $AGoogle1_i$ shows the daily change in Google volume between days -40 and 0 (day 0 = merger announcement day) and $AGoogle2_i$ shows the abnormal daily change between days -40 and 0 above the normal Google activity for each firm as estimated by the median number of searches for each firm between -41 and -50 days before the merger announcement. *** shows significance at the 1 percent level.

Table 2
Google activity and target share returns

	ER_{iM}	ER_{iCAPM}	ER_{iFF3}	ER_{iM}	ER_{iCAPM}	ER_{iFF3}
Panel A: Impact of Google merger signal on share returns (%)						
		$AGoogle1_i$			$AGoogle2_i$	
t	1.68***	1.64***	1.59***	1.74***	1.73***	1.66***
$t+1$	0.93**	0.94**	0.99**	1.57**	1.57**	1.40**
$t+2$	0.58*	0.66*	0.58*	0.81*	1.01**	0.91*
$t+3$	0.92*	1.01*	0.97*	0.25	0.29	0.36
Panel B: Regression analysis						
N	3,461	3,461	3,461	2,345	2,345	2,345
a_1	0.040**	0.038**	0.033*	0.028	0.028	0.027
a_2	0.013	0.014	0.012	0.087***	0.086***	0.085***
a_3	0.038**	0.039**	0.037**	0.010	0.013	0.017
a_4	0.016	0.018	0.021	-0.063**	-0.059**	-0.059**
F-stat	2.082*	2.001*	1.736	3.949***	3.988***	4.083***

Notes: Panel A explores whether Google's abnormal upward changes in $AGoogle1_i$ and $AGoogle2_i$ have an impact on share returns on the day that those signals were identified as well as over the following three days; $t+1$, $t+2$, and $t+3$. Excess returns indicate a simple arithmetic average across all target firms for that day. Panel B explores whether there is in general a relationship between share returns and Google activity by estimating $ER_{it} = a_0 + a_1 AGoogle_{it} + a_2 AGoogle_{it-1} + a_3 AGoogle_{it-2} + a_4 AGoogle_{it-3} + u_{it}$ where all three measures are used to estimate excess returns ER_{it} (ER_{iM}, ER_{iCAPM} and ER_{iFF3}) and both Google's volume are employed ($AGoogle1_i$ and $AGoogle2_i$). The regression is estimated on firms after the initial takeover signal and only the slope coefficients are presented for brevity reasons. N shows the number of observations used. We follow the boxplot method (Tukey, 1977) to identify abnormal upward changes for $AGoogle1_i$ and $AGoogle2_i$, where $AGoogle1_i$ shows the daily change in Google volume and $AGoogle2_i$ shows the abnormal daily change above the normal Google activity for each firm as estimated by the median number of searches for each firm between -41 and -50 days before the merger announcement. ER_{iM} shows the difference between share and market (FTSE All Share) returns, ER_{iCAPM} shows the Capital Asset Pricing Model's risk-adjusted returns, and ER_{iFF3} shows the three-factor model's risk-adjusted returns. *, **, and *** show significance at the 10, 5, and 1 percent levels.

Table 3
Comparison of takeover signals

	$AGoogle1_i$	$AGoogle2_i$	$FT\ \mathrm{cov}erage_i$
Panel A: Coverage of firms			
With a takeover signal	150	116	127
Without a takeover signal	280	314	303
Average days	-20	-20	-16
Median days	-21	-22	-15
Panel B: Agree/disagree signal of merger activity			
$AGoogle1_i$		310/120	249/181
$AGoogle2_i$			243/187
Panel C: First signal of a takeover activity			
$AGoogle1_i$ vs $FT\ \mathrm{cov}erage_i$	34		14
$AGoogle2_i$ vs $FT\ \mathrm{cov}erage_i$		22	6
$AGoogle1_i$ vs $AGoogle2_i$	35	38	

Notes: This table compares signals of takeover activity among $AGoogle1_i$, $AGoogle2_i$, and $FT\ \mathrm{cov}erage_i$. Panel A shows the number of firms with and without a takeover signal and how many days before the merger (day 0) those signals occur. Panel B explores the extent to which alternative indicators predict the same outcome as to whether a firm would become a target firm. As an example $AGoogle1_i$ and FT similarly identify the outcome in 249 firms, while the outcome differs at the remaining 181 firms. Panel C explores which of the signals appears first. $AGoogle1_i$ shows the daily change in Google volume and $AGoogle2_i$ shows the abnormal daily change above the normal Google activity for each firm as estimated by the median number of searches for each firm between -41 and -50 days before the merger announcement.

Table 4
Estimation of excess returns (%)

	ER_{iM}	ER_{iCAPM}	ER_{iFF3}	ER_{iM}	ER_{iCAPM}	ER_{iFF3}
Panel A: In relation to merger announcement				Panel B: In relation to $AGoogle1_i$		
0	15.74***	15.86***	15.80***	10.25***	10.37***	10.32***
-1	2.31***	2.30***	2.23***	1.34***	1.32***	1.27***
-2	0.84***	0.88***	0.94***	0.43**	0.50***	0.58***
-3	0.31*	0.32**	0.25	0.34*	0.42**	0.29*
-4	0.56***	0.64***	0.60***	0.13	0.23	0.12
-5	0.18	0.22	0.18	-0.05	-0.02	-0.08
CAR (-1, -10)	5.09***	5.56***	5.25***	2.43***	3.03***	2.68***
CAR (-11, -20)	2.69***	3.05***	2.75***	2.70***	3.20***	2.97***
CAR (-21, -30)	1.53***	2.21***	2.04***	0.78	1.64***	1.54***
CAR (-1, -30)	9.30***	10.82***	10.04***	5.91***	7.88***	7.20***
Panel C: In relation to $AGoogle2_i$				Panel D: $AGoogle1_i - FT$		
0	11.82***	11.97***	11.94***	-2.50*	-2.48*	-2.57*
-1	1.57***	1.53***	1.52***	-3.44***	-3.46***	-3.34***
-2	0.51***	0.52***	0.63***	-0.52**	-0.55**	-0.47
-3	0.45**	0.50***	0.39**	0.14	0.12	0.04
-4	0.20	0.32**	0.29*	-0.13	-0.09	-0.17
-5	0.06	0.10	0.05	-0.10	-0.14	-0.19
CAR (-1, -10)	3.60***	4.08***	3.87***	-4.02***	-4.07***	-3.97***
CAR (-11, -20)	2.28***	2.64***	2.35***	1.40	1.55*	1.66*
CAR (-21, -30)	1.25***	2.02***	1.92***	0.28	0.39	0.59
CAR (-1, -30)	7.13***	8.74***	8.14***	-2.34	-2.11	-1.71
Panel E: $AGoogle2_i - FT$						
0	-0.93	-0.88	-0.94			
-1	-3.21***	-3.25***	-3.10***			
-2	-0.44	-0.52*	-0.42			
-3	0.25	0.21	0.14			
-4	-0.06	0.00	0.00			
-5	0.01	-0.02	-0.06			
CAR (-1, -10)	-2.86***	-3.02***	-2.78***			
CAR (-11, -20)	0.98	0.99	1.04			
CAR (-21, -30)	0.75	0.77	0.97			
CAR (-1, -30)	-1.13	-1.25	-0.77			

Notes: This table shows the estimation of excess returns prior to the merger announcement (Panel A), prior to $AGoogle1_i$ (Panel B), and prior to $AGoogle2_i$ (Panel C). Therefore '0' represents the merger announcement day at Panel A and either the day with the first $AGoogle1_i$ / $AGoogle2_i$ signal or otherwise the merger announcement day at Panels B and C. -1, -2, -3, -4 and -5 show days prior day 0. Panels D and E compare the excess returns found in FT in comparison to those reported in $AGoogle1_i$ and $AGoogle2_i$, respectively. $AGoogle1_i$ shows the daily change in Google volume and $AGoogle2_i$ shows the abnormal daily change above the normal Google activity for each firm as estimated by the median number of searches for each firm between -41 and -50 days before the merger announcement. Excess returns at day t indicate a simple arithmetic average across all target firms for that day and CAR(j,k) indicates the sum of those daily excess returns between day j and k. We follow alternative risk-adjusted excess returns: ER_{iM} shows the difference

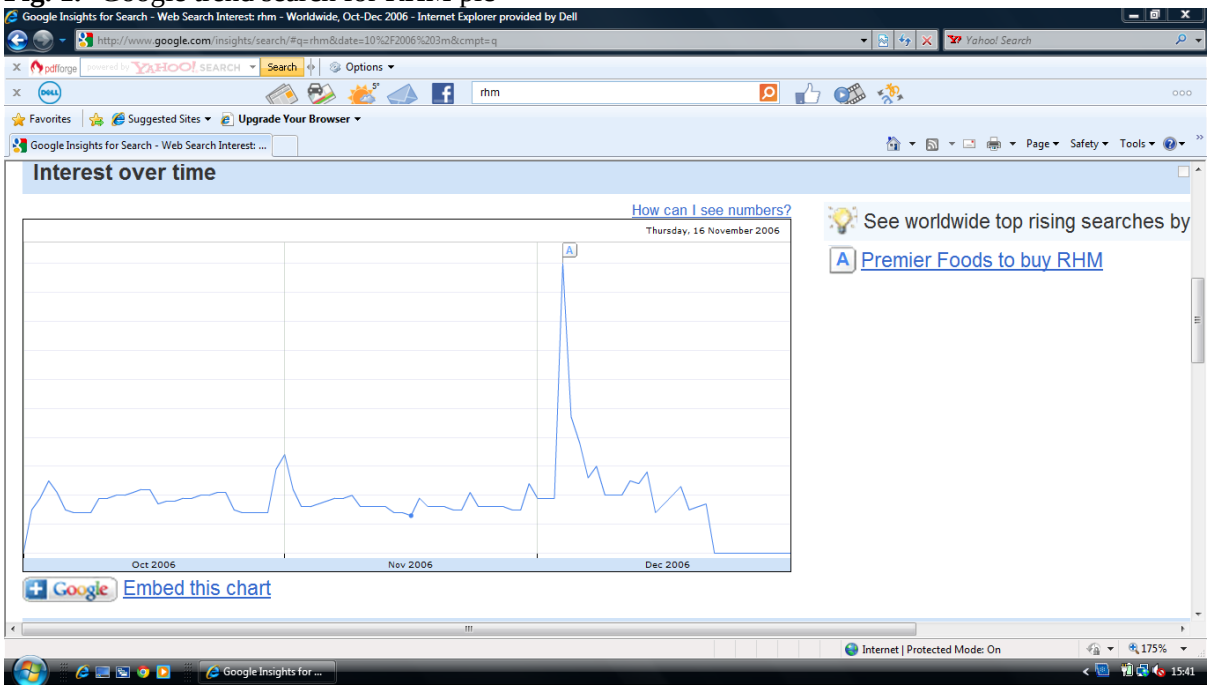
between share and market (FTSE All Share) returns, ER_{iCAPM} shows the Capital Asset Pricing Model's risk-adjusted returns, and ER_{iFF3} shows the three-factor model's risk-adjusted returns. *, **, and *** show significance at the 10, 5, and 1 percent levels.

Table 5
Robustness tests (%)

	ER_{iM}	ER_{iCAPM}	ER_{iFF3}	ER_{iM}	ER_{iCAPM}	ER_{iFF3}	ER_{iM}	ER_{iCAPM}	ER_{iFF3}	ER_{iM}	ER_{iCAPM}	ER_{iFF3}
	Panel A: Excluding noisy tickers			Panel B: Excluding firms with less than 100% merger activity			Panel C: Excluding financials			Panel D: Excluding firms with financial year end results 60 days before their merger announcement		
						CAR (-1,-10)						
In relation to $AGoogle1_i$	2.53***	3.22***	2.82***	3.06***	3.69***	3.31***	2.89***	3.43***	2.91***	2.33***	2.87***	2.40***
In relation to $AGoogle2_i$	3.78***	4.35***	4.11***	3.92***	4.56***	4.26***	4.09***	4.49***	4.11***	3.07***	3.43***	3.18***
$AGoogle1_i - FT$	-4.12***	-4.14***	-4.09***	-3.90***	-4.01***	-3.88***	-4.17***	-4.36***	-4.40***	-3.79***	-3.81***	-3.75***
$AGoogle2_i - FT$	-2.87***	-3.01***	-2.80**	-3.04***	-3.14***	-2.93***	-2.97***	-3.30***	-3.20***	-3.05***	-3.25***	-2.97***
						CAR (-1,-30)						
In relation to $AGoogle1_i$	6.03***	8.23***	7.35***	6.94***	9.16***	8.43***	6.58***	8.28***	7.27***	5.76***	7.23***	6.36***
In relation to $AGoogle2_i$	7.33***	9.15***	8.37***	8.41***	10.48***	9.85***	7.83***	9.13***	8.19***	6.56***	7.61***	6.90***
$AGoogle1_i - FT$	-2.42	-2.14	-1.73	-2.07	-1.91	-1.46	-2.70	-2.68	-2.30	-2.51	-2.27	-1.98
$AGoogle2_i - FT$	-1.12	-1.22	-0.71	-0.60	-0.59	-0.04	-1.45	-1.83	-1.38	-1.71	-1.89	-1.44

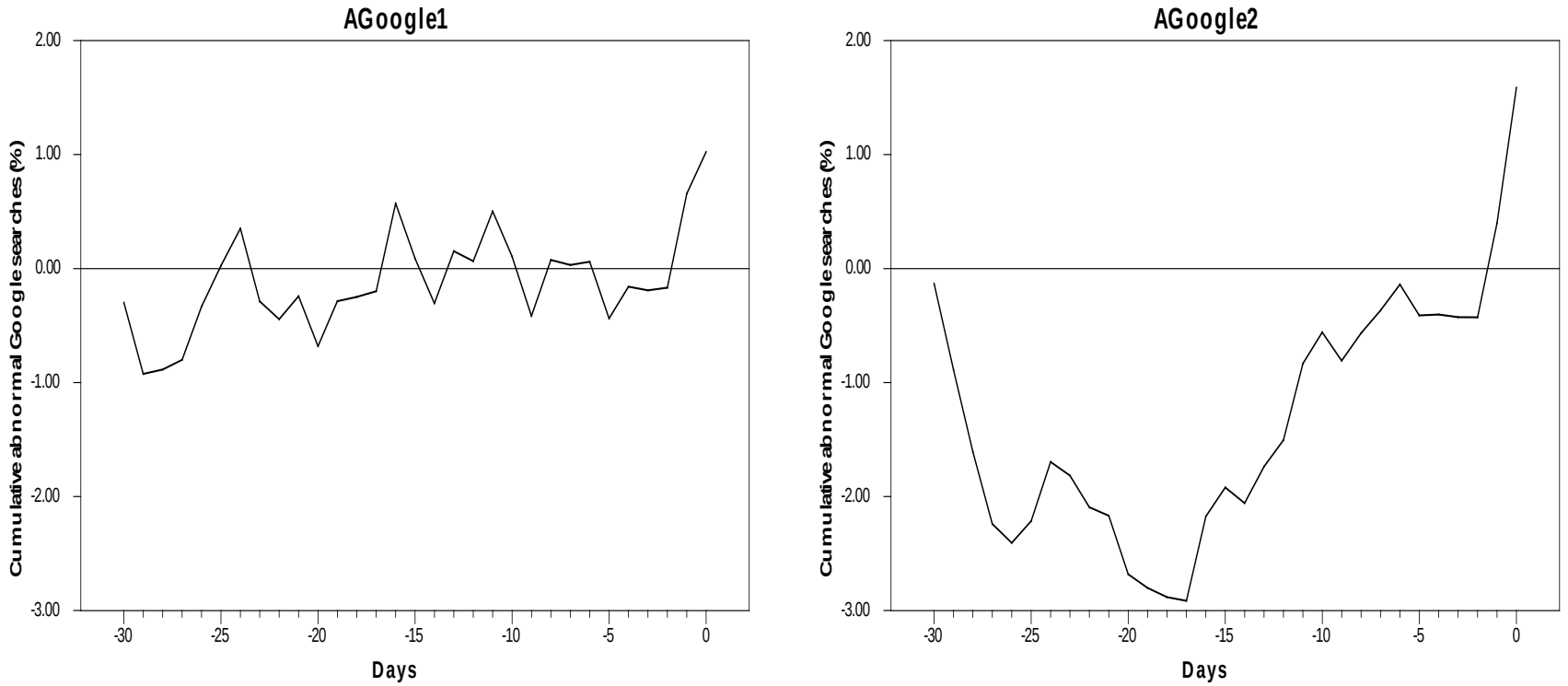
Notes: This table shows the excess returns of three robustness tests when excluding noisy tickers (Panel A), when excluding target firms with less than 100 percent merger activity (Panel B), when excluding financials (Panel C) and when excluding firms with financial year end results up to 60 days prior to their merger announcement (Panel D). CAR *(j ,k)* indicates the cumulative excess returns in the interval between days *j* and *k*. $AGoogle1_i$ shows the daily change in Google volume and $AGoogle2_i$ shows the abnormal daily change above the normal Google activity for each firm as estimated by the median number of searches for each firm between -41 and -50 days before the merger announcement. We follow alternative risk-adjusted excess returns: ER_{iM} shows the difference between share and market (FTSE All Share) returns, ER_{iCAPM} shows the Capital Asset Pricing Model's risk-adjusted returns, and ER_{iFF3} shows the three-factor model's risk-adjusted returns. ** and *** show significance at the 5 and 1 percent levels.

Fig. 1. Google trend search for RHM plc



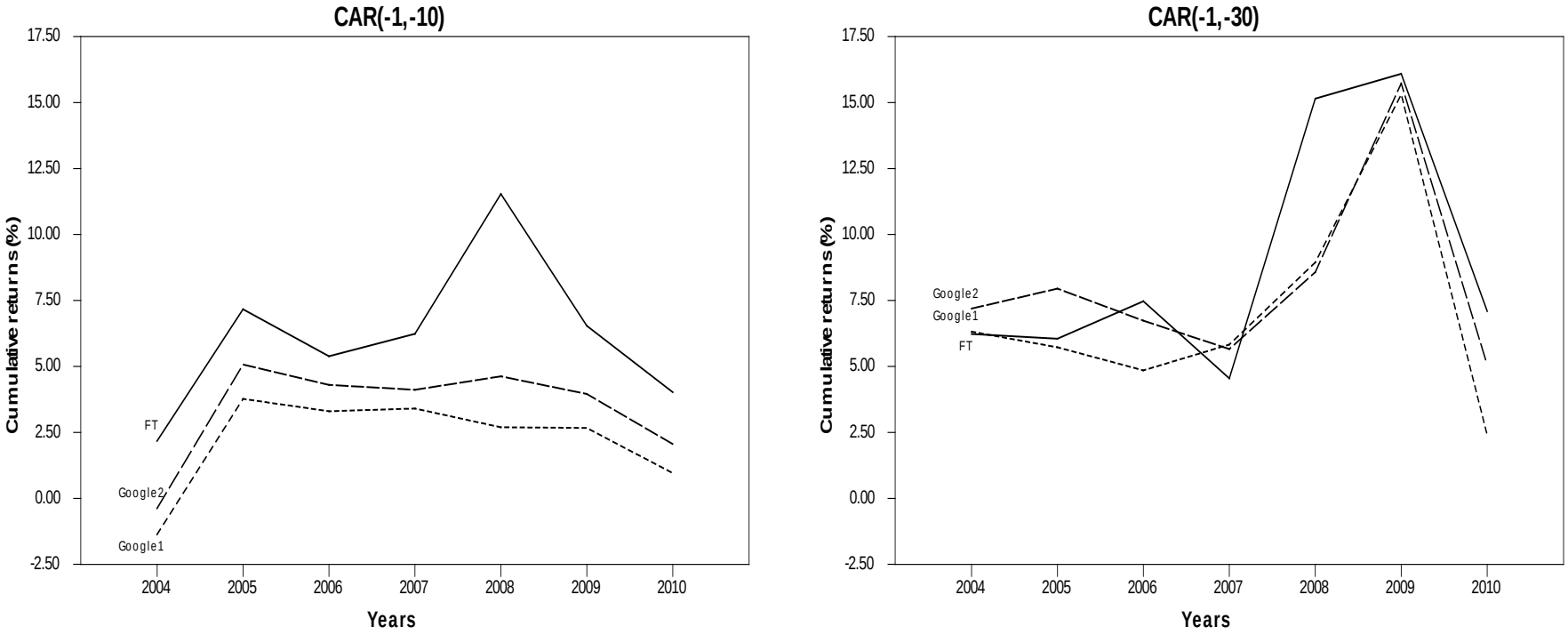
Notes: This figure represents the daily output for a Google trend search of 'RHM' between October and December 2006. High/low historic trend indicates high/low numbers of searches in Google. Notice that RHM plc was acquired by Premier Foods plc on 4th December 2006.

Fig. 2. Cumulative abnormal Google searches



Notes: This figure shows the cumulative Google volume until the merger announcement day (day 0). $AGoogle1_i$ shows the daily change in Google volume and $AGoogle2_i$ shows the abnormal daily change above the normal Google activity for each firm as estimated by the median number of searches for each firm between -41 and -50 days before the merger announcement.

Fig. 3. Annual excess returns (ER_{iFF3})



Notes: This figure shows the annual cumulative excess returns in the interval between (-1,-10) and (-1,-30) for FT coverage, $AGoogle1_i$, and $AGoogle2_i$ during the sample period. $AGoogle1_i$ shows the daily change in Google volume and $AGoogle2_i$ shows the abnormal daily change above the normal Google activity for each firm as estimated by the median number of searches for each firm between -41 and -50 days before the merger announcement. For brevity reasons, results are shown only for ER_{iFF3}, which shows the three-factor model's risk-adjusted returns (conclusions remain unchanged when alternative excess return methods are estimated).